The influence of cattle height on the activity of shoulder muscles in veterinarians during rectal palpations

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1. Introduction

1.1 Background

Bovine veterinarians are health care professionals specialising in the treatment of cattle. Veterinarians are integrally involved in monitoring the health and reproductive status of the cattle. The monitoring of reproductive capability in cattle involves the veterinarian diagnosing and monitoring pregnancy (Hill et al., 1998; Reijula et al., 2003). This kind of pregnancy diagnosis is most commonly done via rectal palpations, due to the ease, low cost and efficiency of the procedure. Rectal palpations involve the veterinarian extending his/her arm into the cow's rectum in order to palpate the uterus, allowing determination of the stage of pregnancy and the health of the calf (Berry et al., 2012; Lucas et al., 2013). Rectal palpations are performed against the abdominal pressures of the animal, as well as the resistance and movement of the animal (Scuffham, 2009). Rectal palpations have been reported as exposing veterinarians to a very high risk of injury, with 71% of injuries in large animal veterinarians being injured as a result of rectal palpations (Nienhaus et al., 2005; Lucas et al., 2009; Scuffham et al., 2010; Berry et al., 2012; Lucas et al., 2013). The act of shoulder extension and the highly repetitive nature of rectal palpations (up to 250 per day) could lead to the development of musculoskeletal disorders and other traumatic injuries (Hill et al., 1998; Jeyaretnam and Jones, 2000; Lucas et al., 2009; Scuffham et al., 2010; Berry et al., 2012; Lucas et al., 2013).

1.2 Statement of the Problem

Scuffham (2009) stated that to date no study had investigated the possible influences that the veterinarian's height has on these musculoskeletal disorders. Therefore this research aimed to investigate the influence that veterinarian height has on muscular activity of the shoulder region during rectal palpations and infer the possible injury risk, and then compare this to the effect that repetition has on muscular activity.

Hypotheses

1) The muscle activity during rectal palpations will be lowest when there is no difference in height between the cow's rectum and the veterinarian's shoulder. As the height difference changes there will be a corresponding change in the muscle activity.

2) Muscular activity will change as the number of repetitions change, i.e. as the veterinarian performs more rectal palpations the muscular activity will also change.

3) In case there is a change in muscular activity, this change will be more significantly affected by the height difference between cow rectal height and veterinarian shoulder height than it will be by the number of repetitions.

2. Method

2.1 Experimental Concept

Cows are large animals and due to their size and nature a field based study was selected. This also allowed for a more realistic scenario because the veterinarian was able to perform the rectal palpations in the same setting and in the same manner as he would normally do.

A correlational study was performed, investigating whether muscular activity of the Trapezius, Medial Deltoid and Anterior Deltoid muscles in the veterinarian correlates to the rectal height of the cow that he examines. Surface Electromyography (EMG) was used to measure these three muscles. The muscle activity was then correlated to changes in height difference between the veterinarian's shoulder and the cow's rectum. The muscle activity was also correlated with the increasing number of repetitions. Only fully qualified
bovine veterinarians could take part in this research in order to avoid injury of both the participant and the cow. This also ensured that the palpations were performed correctly allowing more accurate results. However, this lead to a significant limitation of the study that only two qualified veterinarians are working in a 100km radius around Grahamstown who were both involved in a study. This lead to a sample size of n=2. In order to compensate for the small sample size a high number of repetitions was analysed (n>90 for each participant and each day) on two day for each veterinarian.

2.2 Procedure

Electrodes were placed on the selected sites according to guidelines provided by Nussbaum (2001). Once the electrodes and heart rate belt were positioned the veterinarian was asked to perform a maximum voluntary contraction (MVC). This was done as a baseline measure. Each muscle had a separate MVC procedure in order to isolate that muscle. Once the MVCs were performed the veterinarian was required to perform the rectal palpations in the same manner and at the same rate as he would normally do.

The height of each cow’s rectum was measured using a 150cm yard stick.

2.3 Data Reduction and Statistical Analysis

The muscle activity for each muscle was normalised and expressed as a percentage of MVC and then correlated with height difference and the number of repetitions. A multiple regression analysis was performed for both height and repetition correlations with muscle activity.

3. Results

3.1 Height Difference

There was no significant (p>0.05) relationship between height difference and muscle activity for any of the three muscles. The coefficient of determination was for all muscles investigated smaller than 0.003. In the presented study there is therefore no relationship observed between the rectal height of the cow and the muscular activity of the investigated muscles.

3.2 Repetition

From table 1 it can be seen that there was large variation between the different muscles and the different days. The trapezius muscle had a significant, negative relationship on day one but not significant relationship on day two. The medial deltoid had no significant relationships on either day one or two. The anterior deltoid muscle had a negative, but significant relationship on day one and a positive, significant relationship on day two.

The significant relationships indicate that there any changes in muscle activity can be directly attributed to changes in the number of repetitions performed. The negative relationships indicate that as repetitions increased the muscle activity decreased and positive relationships indicate that muscle activity increased with repetition.

Table 1. Correlation between the number of repetitions and the muscular activity (in %MVC)

<table>
<thead>
<tr>
<th>Muscle (day of analysis)</th>
<th>Slope of regression line</th>
<th>Coefficient of determination</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>M. Trapezius (day 1)</td>
<td>-.032</td>
<td>.062</td>
<td>.018</td>
</tr>
<tr>
<td>M. Trapezius (day 2)</td>
<td>.042</td>
<td>.037</td>
<td>.069</td>
</tr>
<tr>
<td>M. Deltoid medial (day 1)</td>
<td>-.00</td>
<td>.000</td>
<td>.903</td>
</tr>
<tr>
<td>M. Deltoid medial (day 2)</td>
<td>-.01</td>
<td>.011</td>
<td>.313</td>
</tr>
<tr>
<td>M. Deltoid anterior (day 1)</td>
<td>-.043</td>
<td>.050</td>
<td>.035</td>
</tr>
<tr>
<td>M. Deltoid anterior (day 2)</td>
<td>.067</td>
<td>.072</td>
<td>.010</td>
</tr>
</tbody>
</table>
3.2 Heart Rate

There was no significant (p>0.05) relationship between heart rate and height differences. There was also no significant (p>0.05) correlation between heart rate and changing repetitions for day one. However, there was a significant (p<0.05) relationship between heart rate and increasing repetitions for day two ($R^2 = 0.47593261$ and $m = 0.2618$ ($F (1.89) = 80.82549$, $p=0.0000001$). This indicates that there might be an increase of heart rate with the number of repetitions performed but that heart rate is also affected by other factors.

4. Conclusion

Based on the results of this research it can be concluded that

- A positive height difference is not likely to cause injury due to the non-significant correlation with muscle activity of these three muscles.
- Repetition is more likely to lead to the development of musculoskeletal disorders as can be seen by the significant changes in muscle activity of certain muscles. This is in agreement with previous research indicating repetition as a leading cause of musculoskeletal disorders.
- More research is needed in order to investigate other possible mechanisms of injury, as well as investigating the effects of height difference on shorter veterinarians, i.e. a negative height difference. A larger participant group is also needed.

References


